| | |
|---|---|
| **BISMARCK ND** | |
| Latitude = 46.77 N | WMO No. 727640 |
| Longitude =100.70 W | Elevation = 1660 feet |
| Period of Record = 1973 to 1996 | Average Pressure = 28.19 inches Hg |

## Design Criteria Data

| | | Mean Coincident (Average) Values | | | |
|---|---|---|---|---|---|
| **Dry Bulb Temperature (T)** | **Design Value ($^oF$)** | Wet Bulb Temperature ($^oF$) | Humidity Ratio (gr/lb) | Wind Speed (mph) | Prevailing Direction (NSEW) |
| Median of Extreme Highs | 100 | 70 | 68 | 13.6 | S |
| 0.4% Occurrence | 94 | 69 | 72 | 13.1 | S |
| 1.0% Occurrence | 90 | 68 | 72 | 12.3 | S |
| 2.0% Occurrence | 86 | 66 | 71 | 12.1 | S |
| Mean Daily Range | 23 | - | - | - | - |
| 97.5% Occurrence | -9 | -9 | 2 | 9.1 | WNW |
| 99.0% Occurrence | -16 | -16 | 2 | 7.7 | W |
| 99.6% Occurrence | -21 | -21 | 1 | 6.5 | NW |
| Median of Extreme Lows | -28 | -28 | 1 | 5.8 | W |
| | | Mean Coincident (Average) Values | | | |
| **Wet Bulb Temperature ($T_{wb}$)** | **Design Value ($^oF$)** | Dry Bulb Temperature ($^oF$) | Humidity Ratio (gr/lb) | Wind Speed (mph) | Prevailing Direction (NSEW) |
| Median of Extreme Highs | 77 | 88 | 129 | 11.3 | S |
| 0.4% Occurrence | 73 | 86 | 107 | 11.8 | S |
| 1.0% Occurrence | 71 | 85 | 97 | 11.8 | SSE |
| 2.0% Occurrence | 69 | 83 | 90 | 11.3 | S |
| | | Mean Coincident (Average) Values | | | |
| **Humidity Ratio (HR)** | **Design Value (gr/lb)** | Dry Bulb Temperature ($^oF$) | Vapor Pressure (in. Hg) | Wind Speed (mph) | Prevailing Direction (NSEW) |
| Median of Extreme Highs | 126 | 82 | 0.79 | 9.7 | E |
| 0.4% Occurrence | 114 | 79 | 0.72 | 9.8 | E |
| 1.0% Occurrence | 102 | 76 | 0.65 | 9.5 | S |
| 2.0% Occurrence | 95 | 74 | 0.60 | 9.2 | SSE |
| **Air Conditioning/** | | $T \geq 93^oF$ | $T \geq 80^oF$ | $T_{wb} \geq 73^oF$ | $T_{wb} \geq 67^oF$ |
| **Humid Area Criteria** | # of Hours | 47 | 466 | 41 | 321 |

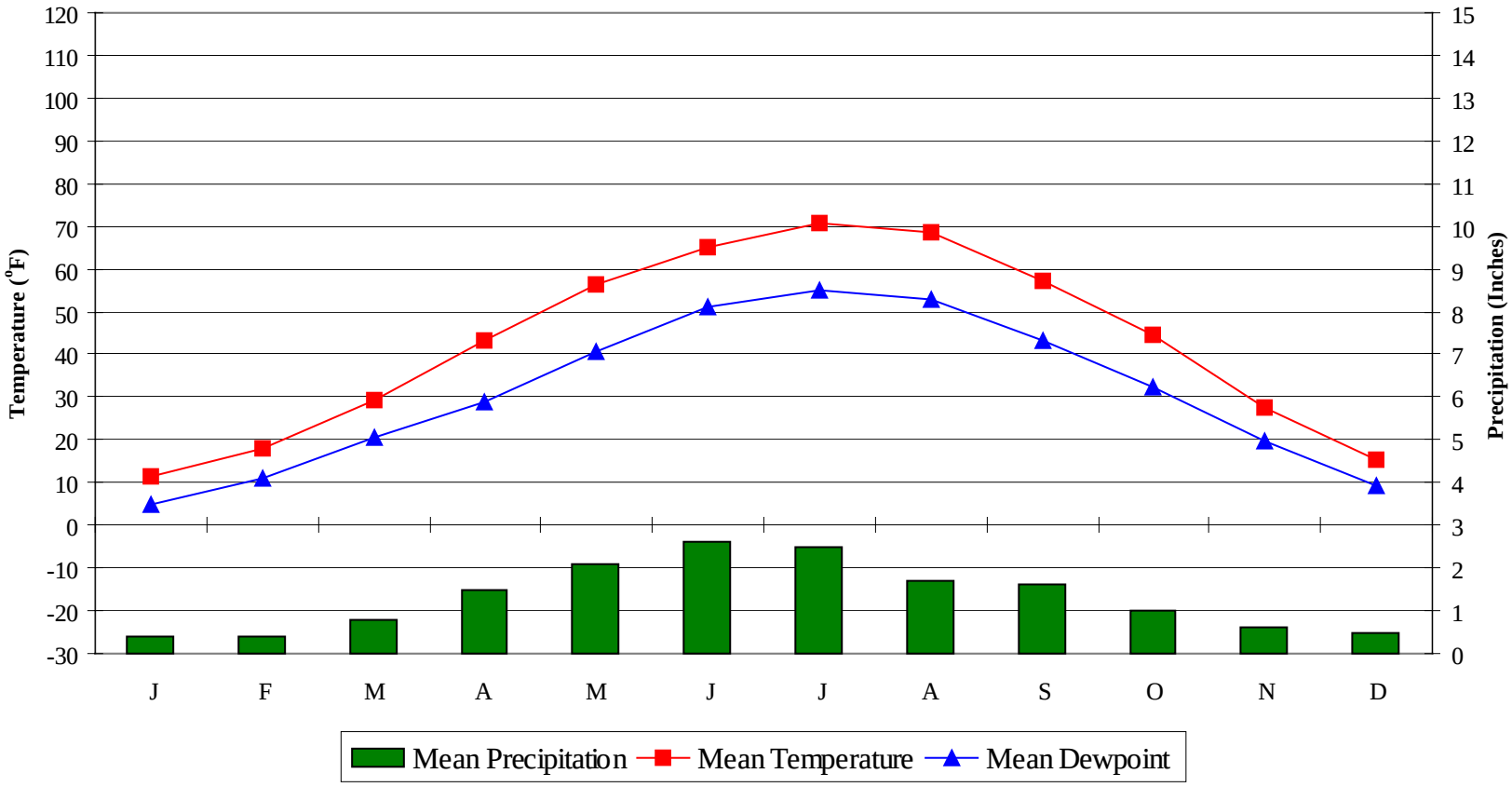
**Other Site Data**

| Weather Region | Rain Rate 100 Year Recurrence (in./hr) | Basic Wind Speed 3 sec gust @ 33 ft 50 Year Recurrence (mph) | Ventilation Cooling Load Index (Ton-hr/cfm/yr) Base $75^oF$-RH 60% Latent + Sensible |
|---|---|---|---|
| 5 | 3.0 | 90 | 0.3 + 0.5 |
| **Ground Water Temperature ($^oF$) 50 Foot Depth *** | **Frost Depth 50 Year Recurrence (in.)** | **Ground Snow Load 50 Year Recurrence ($lb/ft^2$)** | **Average Annual Freeze-Thaw Cycles (#)** |
| 44.8 | 150 | 27 | 87 |

*Note: Temperatures at greater depths can be estimated by adding $1.5^oF$ per 100 feet additional depth.

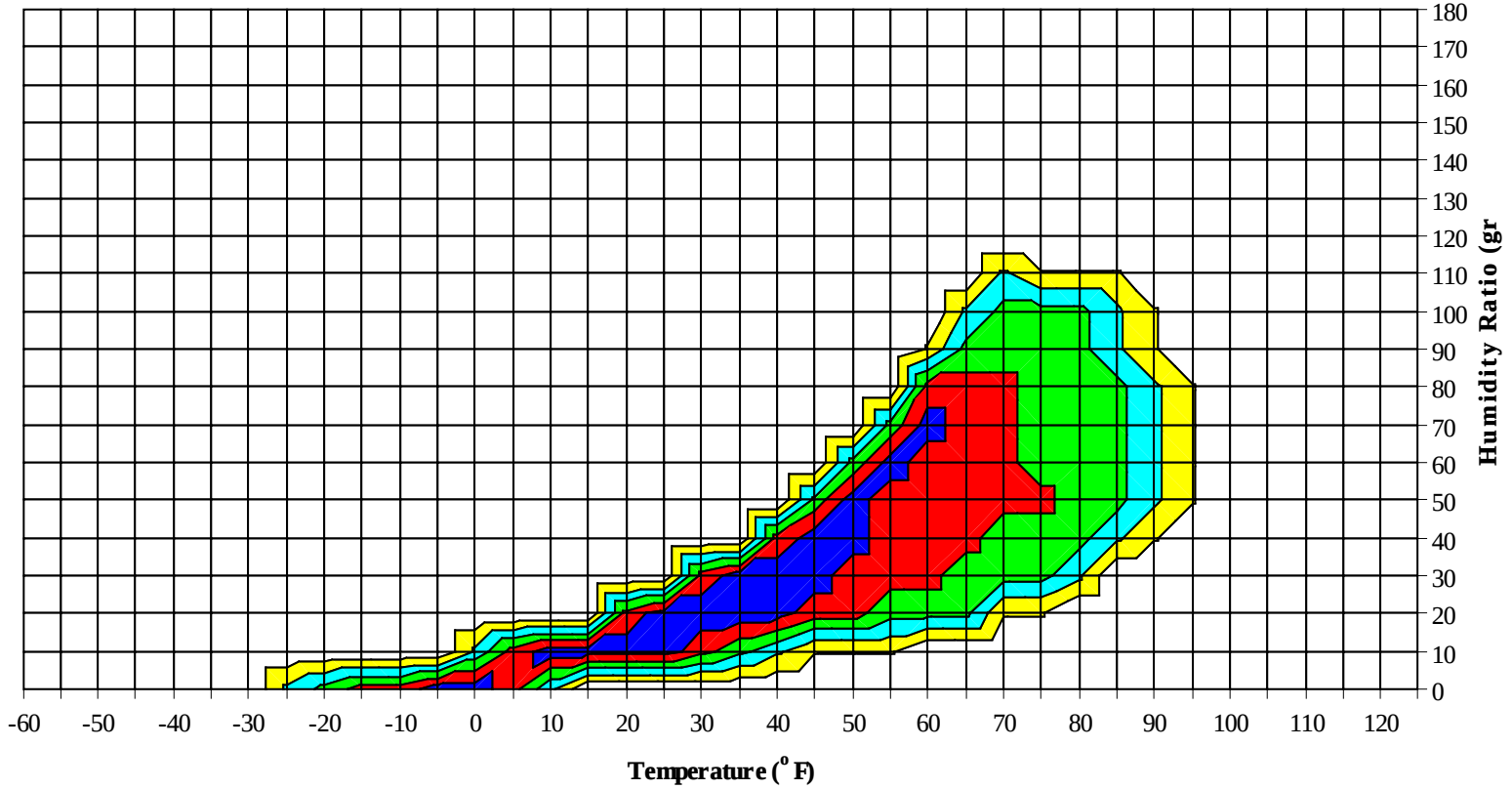
**BISMARCK ND** WMO No. 727640

## Average Annual Climate



**BISMARCK ND** WMO No. 727640

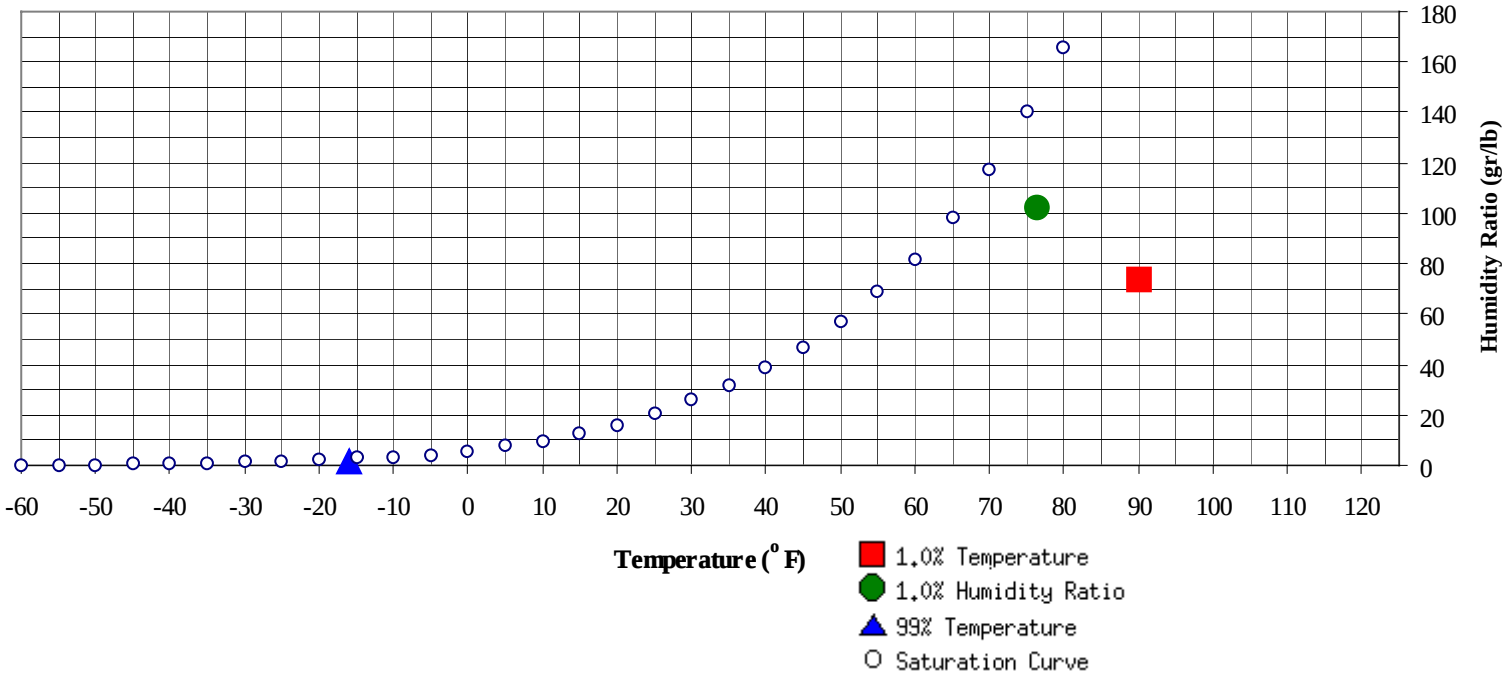
## Long Term Psychrometric Summary




- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

**BISMARCK ND** WMO No. 727640

## Psychrometric Summary of Peak Design Values




| | (°F) | MCHR (gr/lb) | Enthalpy (btu/lb) |
|---|---|---|---|
| **99% Dry Bulb** | -16 | 1.6 | -3.6 |

| | (gr/lb) | MCDB (°F) | MCWB (°F) | MC Dewpt (°F) | Enthalpy (btu/lb) |
|---|---|---|---|---|---|
| **1.0% Humidity Ratio** | 102.2 | 76.4 | 69.2 | 66 | 34.3 |

| | (°F) | MCHR (gr/lb) | MCWB (°F) | Enthalpy (btu/lb) |
|---|---|---|---|---|
| **1.0% Dry Bulb** | 90 | 73.6 | 67.8 | 33.2 |

**BISMARCK ND** WMO No. 727640

## Dry-Bulb Temperature Hours For An Average Year (Sheet 1 of 5)

**Period of Record = 1973 to 1996**

| Temperature Range (°F) | January Hour Group (LST) 01 To 08 | January 09 To 16 | January 17 To 00 | January Total Obs | January MCWB (°F) | February Hour Group (LST) 01 To 08 | February 09 To 16 | February 17 To 00 | February Total Obs | February MCWB (°F) | March Hour Group (LST) 01 To 08 | March 09 To 16 | March 17 To 00 | March Total Obs | March MCWB (°F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **105 / 109** | | | | | | | | | | | | | | | |
| **100 / 104** | | | | | | | | | | | | | | | |
| **95 / 99** | | | | | | | | | | | | | | | |
| **90 / 94** | | | | | | | | | | | | | | | |
| **85 / 89** | | | | | | | | | | | | | | | |
| **80 / 84** | | | | | | | | | | | | | | | |
| **75 / 79** | | | | | | | | | | | | 0 | 0 | 0 | 52.8 |
| **70 / 74** | | | | | | | | | | | | 1 | 0 | 1 | 52.9 |
| **65 / 69** | | | | | | | 0 | 0 | 0 | 49.3 | | 1 | 1 | 2 | 50.3 |
| **60 / 64** | | 0 | | 0 | 47.0 | | 0 | 0 | 1 | 46.5 | 0 | 4 | 2 | 5 | 47.2 |
| **55 / 59** | | 0 | 0 | 0 | 45.0 | | 1 | 0 | 2 | 44.9 | 0 | 9 | 5 | 13 | 44.3 |
| **50 / 54** | | 0 | 0 | 0 | 41.2 | | 5 | 1 | 6 | 42.5 | 1 | 13 | 8 | 22 | 42.2 |
| **45 / 49** | | 4 | 1 | 4 | 38.8 | 0 | 8 | 3 | 12 | 39.2 | 2 | 21 | 14 | 37 | 39.4 |
| **40 / 44** | 1 | 10 | 5 | 17 | 36.3 | 2 | 15 | 10 | 26 | 36.4 | 8 | 32 | 27 | 67 | 36.7 |
| **35 / 39** | 8 | 15 | 15 | 37 | 33.4 | 12 | 20 | 23 | 55 | 33.3 | 27 | 47 | 45 | 119 | 33.6 |
| **30 / 34** | 14 | 22 | 21 | 56 | 29.3 | 22 | 25 | 32 | 79 | 29.7 | 60 | 39 | 50 | 149 | 30.0 |
| **25 / 29** | 20 | 23 | 26 | 69 | 25.2 | 32 | 27 | 28 | 87 | 25.5 | 44 | 24 | 32 | 100 | 25.1 |
| **20 / 24** | 28 | 26 | 26 | 80 | 20.7 | 27 | 23 | 24 | 74 | 20.7 | 34 | 20 | 23 | 77 | 20.4 |
| **15 / 19** | 28 | 24 | 27 | 79 | 16.0 | 22 | 19 | 20 | 61 | 15.8 | 23 | 13 | 16 | 53 | 15.8 |
| **10 / 14** | 23 | 24 | 23 | 70 | 10.9 | 22 | 21 | 20 | 63 | 10.7 | 14 | 10 | 10 | 35 | 10.8 |
| **5 / 9** | 26 | 21 | 22 | 69 | 6.0 | 22 | 19 | 19 | 59 | 6.0 | 14 | 6 | 6 | 26 | 6.1 |
| **0 / 4** | 21 | 22 | 19 | 62 | 1.2 | 18 | 14 | 17 | 49 | 1.1 | 6 | 4 | 6 | 16 | 1.0 |
| **-5 / -1** | 17 | 15 | 16 | 48 | -3.3 | 11 | 9 | 11 | 32 | -3.2 | 5 | 2 | 3 | 9 | -3.1 |
| **-10 / -6** | 22 | 19 | 20 | 60 | -7.6 | 13 | 8 | 7 | 28 | -7.4 | 5 | 1 | 1 | 7 | -7.4 |
| **-15 / -11** | 17 | 12 | 16 | 44 | -12.3 | 9 | 4 | 4 | 17 | -12.2 | 2 | 0 | 0 | 3 | -11.4 |
| **-20 / -16** | 11 | 5 | 9 | 25 | -16.9 | 5 | 2 | 3 | 10 | -16.9 | 1 | 0 | 0 | 1 | -16.7 |
| **-25 / -21** | 10 | 3 | 3 | 15 | -21.7 | 4 | 1 | 2 | 7 | -21.9 | 1 | | | 1 | -22.0 |
| **-30 / -26** | 4 | 1 | 1 | 5 | -26.4 | 2 | 1 | 1 | 3 | -26.6 | 0 | | | 0 | -26.7 |
| **-35 / -31** | 1 | 0 | 0 | 1 | -32.4 | 1 | 0 | 0 | 1 | -31.9 | | | | | |
| **-40 / -36** | 0 | 0 | | 0 | -35.5 | 0 | 0 | | 1 | -35.0 | | | | | |
| **-45 / -41** | | | | | | 0 | | | 0 | | | | | | |

**Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.**

**BISMARCK ND** WMO No. 727640

## Dry-Bulb Temperature Hours For An Average Year (Sheet 2 of 5)

## Period of Record = 1973 to 1996

| Temperature Range (°F) | April Hour Group (LST) 01 To 08 | April 09 To 16 | April 17 To 00 | April Total Obs | April MCWB (°F) | May Hour Group (LST) 01 To 08 | May 09 To 16 | May 17 To 00 | May Total Obs | May MCWB (°F) | June Hour Group (LST) 01 To 08 | June 09 To 16 | June 17 To 00 | June Total Obs | June MCWB (°F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **105 / 109** | | | | | | | | | | | | 0 | 0 | 0 | 71.0 |
| **100 / 104** | | | | | | | | | | | | 0 | 0 | 1 | 71.0 |
| **95 / 99** | | | | | | | 0 | | 0 | 64.0 | | 2 | 1 | 3 | 69.3 |
| **90 / 94** | | 0 | 0 | 0 | 61.1 | | 1 | 0 | 2 | 63.7 | 0 | 7 | 4 | 11 | 68.8 |
| **85 / 89** | | 1 | 0 | 2 | 58.9 | | 4 | 2 | 6 | 64.4 | 0 | 15 | 9 | 24 | 67.1 |
| **80 / 84** | | 3 | 1 | 4 | 57.2 | | 13 | 6 | 19 | 62.1 | 1 | 27 | 17 | 44 | 65.2 |
| **75 / 79** | | 6 | 3 | 9 | 55.3 | 0 | 24 | 14 | 38 | 59.8 | 2 | 42 | 27 | 72 | 62.7 |
| **70 / 74** | 0 | 9 | 6 | 14 | 53.5 | 2 | 33 | 22 | 57 | 57.0 | 10 | 46 | 36 | 92 | 60.4 |
| **65 / 69** | 0 | 13 | 8 | 22 | 50.4 | 6 | 39 | 28 | 74 | 54.6 | 24 | 43 | 42 | 108 | 58.4 |
| **60 / 64** | 2 | 20 | 14 | 36 | 48.0 | 17 | 42 | 38 | 97 | 52.1 | 46 | 31 | 42 | 120 | 56.4 |
| **55 / 59** | 5 | 28 | 20 | 54 | 45.4 | 36 | 33 | 41 | 110 | 49.8 | 58 | 17 | 34 | 109 | 53.4 |
| **50 / 54** | 11 | 34 | 29 | 74 | 42.9 | 49 | 28 | 39 | 117 | 46.8 | 53 | 7 | 21 | 80 | 49.5 |
| **45 / 49** | 19 | 34 | 33 | 86 | 40.4 | 49 | 16 | 28 | 92 | 43.0 | 29 | 1 | 7 | 38 | 45.3 |
| **40 / 44** | 38 | 35 | 42 | 115 | 37.4 | 41 | 10 | 18 | 69 | 38.8 | 14 | 0 | 1 | 15 | 40.8 |
| **35 / 39** | 50 | 28 | 38 | 116 | 33.8 | 25 | 4 | 8 | 37 | 34.2 | 2 | | 0 | 2 | 36.9 |
| **30 / 34** | 53 | 17 | 27 | 97 | 29.8 | 17 | 1 | 3 | 21 | 30.2 | 0 | | 0 | 0 | 31.7 |
| **25 / 29** | 35 | 6 | 12 | 53 | 25.3 | 5 | 0 | 0 | 5 | 25.9 | | | | | |
| **20 / 24** | 17 | 2 | 5 | 24 | 20.9 | 1 | | | 1 | 21.6 | | | | | |
| **15 / 19** | 5 | 1 | 1 | 8 | 15.7 | 0 | | | 0 | 17.0 | | | | | |
| **10 / 14** | 1 | 1 | 1 | 2 | 10.7 | | | | | | | | | | |
| **5 / 9** | 1 | 0 | 1 | 2 | 5.8 | | | | | | | | | | |
| **0 / 4** | 1 | 0 | 0 | 1 | 1.6 | | | | | | | | | | |
| **-5 / -1** | 0 | | 0 | 0 | -2.8 | | | | | | | | | | |
| **-10 / -6** | 0 | | 0 | 0 | -6.0 | | | | | | | | | | |
| **-15 / -11** | | | | | | | | | | | | | | | |
| **-20 / -16** | | | | | | | | | | | | | | | |
| **-25 / -21** | | | | | | | | | | | | | | | |
| **-30 / -26** | | | | | | | | | | | | | | | |
| **-35 / -31** | | | | | | | | | | | | | | | |
| **-40 / -36** | | | | | | | | | | | | | | | |
| **-45 / -41** | | | | | | | | | | | | | | | |

**Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.**

**BISMARCK ND** WMO No. 727640

## Dry-Bulb Temperature Hours For An Average Year (Sheet 3 of 5)

## Period of Record = 1973 to 1996

| Temperature Range (°F) | July Hour Group (LST) 01 To 08 | July 09 To 16 | July 17 To 00 | July Total Obs | July MCWB (°F) | August Hour Group (LST) 01 To 08 | August 09 To 16 | August 17 To 00 | August Total Obs | August MCWB (°F) | September Hour Group (LST) 01 To 08 | September 09 To 16 | September 17 To 00 | September Total Obs | September MCWB (°F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **105 / 109** | | 0 | 0 | 0 | 69.3 | | | | | | | | | | |
| **100 / 104** | | 2 | 1 | 3 | 70.6 | | 1 | 0 | 1 | 70.2 | | 1 | 0 | 1 | 66.0 |
| **95 / 99** | | 6 | 4 | 9 | 69.9 | | 5 | 2 | 7 | 69.0 | | 1 | 0 | 1 | 66.2 |
| **90 / 94** | | 17 | 10 | 27 | 68.8 | | 17 | 9 | 27 | 68.2 | | 3 | 1 | 4 | 66.2 |
| **85 / 89** | 0 | 32 | 19 | 50 | 67.0 | 0 | 26 | 15 | 41 | 66.6 | 0 | 8 | 4 | 13 | 63.8 |
| **80 / 84** | 1 | 49 | 31 | 81 | 65.4 | 1 | 37 | 24 | 61 | 65.0 | 0 | 14 | 7 | 21 | 62.2 |
| **75 / 79** | 7 | 57 | 40 | 104 | 63.7 | 4 | 45 | 36 | 85 | 63.2 | 1 | 20 | 12 | 33 | 59.9 |
| **70 / 74** | 23 | 45 | 44 | 112 | 62.6 | 16 | 46 | 44 | 106 | 61.4 | 2 | 30 | 18 | 50 | 57.8 |
| **65 / 69** | 47 | 25 | 43 | 115 | 60.6 | 41 | 35 | 44 | 120 | 59.8 | 7 | 36 | 27 | 70 | 55.8 |
| **60 / 64** | 73 | 12 | 37 | 122 | 58.1 | 63 | 21 | 39 | 123 | 57.0 | 19 | 37 | 35 | 91 | 53.6 |
| **55 / 59** | 54 | 3 | 16 | 73 | 54.4 | 56 | 10 | 24 | 90 | 53.3 | 33 | 36 | 40 | 110 | 50.9 |
| **50 / 54** | 32 | 0 | 4 | 36 | 50.4 | 43 | 2 | 10 | 55 | 49.7 | 49 | 28 | 42 | 120 | 47.6 |
| **45 / 49** | 10 | 0 | 0 | 10 | 46.5 | 16 | 0 | 2 | 18 | 45.2 | 49 | 15 | 26 | 90 | 43.6 |
| **40 / 44** | 1 | | | 1 | 42.5 | 7 | 0 | 0 | 8 | 41.1 | 41 | 6 | 18 | 65 | 39.4 |
| **35 / 39** | | | | | | 2 | | | 2 | 37.0 | 25 | 3 | 7 | 35 | 35.0 |
| **30 / 34** | | | | | | 0 | | | 0 | 33.3 | 10 | 0 | 2 | 12 | 30.9 |
| **25 / 29** | | | | | | | | | | | 3 | 0 | 0 | 3 | 26.3 |
| **20 / 24** | | | | | | | | | | | 1 | | 0 | 1 | 21.7 |
| **15 / 19** | | | | | | | | | | | 0 | | | 0 | 15.8 |
| **10 / 14** | | | | | | | | | | | 0 | | | 0 | 12.0 |
| **5 / 9** | | | | | | | | | | | | | | | |
| **0 / 4** | | | | | | | | | | | | | | | |
| **-5 / -1** | | | | | | | | | | | | | | | |
| **-10 / -6** | | | | | | | | | | | | | | | |
| **-15 / -11** | | | | | | | | | | | | | | | |
| **-20 / -16** | | | | | | | | | | | | | | | |
| **-25 / -21** | | | | | | | | | | | | | | | |
| **-30 / -26** | | | | | | | | | | | | | | | |
| **-35 / -31** | | | | | | | | | | | | | | | |
| **-40 / -36** | | | | | | | | | | | | | | | |
| **-45 / -41** | | | | | | | | | | | | | | | |

**Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.**

**BISMARCK ND** WMO No. 727640

## Dry-Bulb Temperature Hours For An Average Year (Sheet 4 of 5)

## Period of Record = 1973 to 1996

| Temperature Range (°F) | October | | | | | November | | | | | December | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hour Group (LST) | | | | MCWB | Hour Group (LST) | | | | MCWB | Hour Group (LST) | | | | MCWB |
| | 01 To 08 | 09 To 16 | 17 To 00 | Total Obs | (°F) | 01 To 08 | 09 To 16 | 17 To 00 | Total Obs | (°F) | 01 To 08 | 09 To 16 | 17 To 00 | Total Obs | (°F) |
| 105 / 109 | | | | | | | | | | | | | | | |
| 100 / 104 | | | | | | | | | | | | | | | |
| 95 / 99 | | | | | | | | | | | | | | | |
| 90 / 94 | | 0 | 0 | 0 | 59.0 | | | | | | | | | | |
| 85 / 89 | | 0 | 0 | 0 | 57.7 | | | | | | | | | | |
| 80 / 84 | | 2 | 0 | 3 | 58.1 | | | | | | | | | | |
| 75 / 79 | | 6 | 2 | 7 | 56.2 | | 0 | | 0 | 56.3 | | | | | |
| 70 / 74 | | 11 | 4 | 15 | 54.4 | | 1 | 0 | 1 | 53.1 | | | | | |
| 65 / 69 | 1 | 18 | 7 | 25 | 52.3 | | 2 | 0 | 2 | 50.3 | | | | | |
| 60 / 64 | 1 | 24 | 14 | 39 | 49.9 | | 3 | 1 | 4 | 48.1 | | | 0 | 0 | 44.0 |
| 55 / 59 | 6 | 31 | 25 | 62 | 47.4 | 0 | 7 | 2 | 10 | 45.4 | | 0 | 0 | 1 | 43.6 |
| 50 / 54 | 16 | 40 | 34 | 90 | 44.6 | 1 | 11 | 6 | 18 | 43.0 | | 1 | 0 | 2 | 41.5 |
| 45 / 49 | 31 | 38 | 41 | 110 | 41.6 | 4 | 16 | 11 | 32 | 40.0 | 0 | 3 | 1 | 4 | 39.0 |
| 40 / 44 | 49 | 34 | 48 | 131 | 38.2 | 11 | 25 | 18 | 54 | 36.5 | 1 | 10 | 4 | 15 | 36.0 |
| 35 / 39 | 53 | 23 | 36 | 112 | 34.0 | 21 | 33 | 29 | 84 | 32.9 | 8 | 18 | 12 | 38 | 33.1 |
| 30 / 34 | 47 | 12 | 21 | 80 | 29.9 | 41 | 40 | 46 | 126 | 29.7 | 16 | 27 | 27 | 69 | 29.5 |
| 25 / 29 | 25 | 5 | 11 | 40 | 25.5 | 43 | 31 | 40 | 115 | 25.2 | 26 | 32 | 33 | 90 | 25.3 |
| 20 / 24 | 13 | 1 | 3 | 17 | 21.1 | 39 | 26 | 31 | 96 | 20.8 | 38 | 34 | 36 | 108 | 20.9 |
| 15 / 19 | 6 | 1 | 1 | 8 | 16.5 | 29 | 16 | 22 | 66 | 16.0 | 35 | 31 | 30 | 96 | 16.1 |
| 10 / 14 | 1 | 1 | 0 | 2 | 11.5 | 21 | 11 | 12 | 44 | 11.2 | 31 | 24 | 27 | 82 | 11.1 |
| 5 / 9 | 0 | 0 | 0 | 0 | 6.1 | 14 | 7 | 11 | 31 | 6.5 | 27 | 20 | 22 | 69 | 6.2 |
| 0 / 4 | 0 | | 0 | 0 | 3.7 | 7 | 4 | 5 | 15 | 1.3 | 21 | 14 | 19 | 54 | 1.1 |
| -5 / -1 | 0 | | 0 | 0 | -2.0 | 4 | 2 | 2 | 7 | -2.9 | 13 | 8 | 9 | 30 | -3.1 |
| -10 / -6 | 0 | | 0 | 0 | -6.2 | 3 | 2 | 3 | 9 | -7.1 | 12 | 10 | 10 | 32 | -7.5 |
| -15 / -11 | | | | | | 2 | 0 | 1 | 3 | -11.5 | 8 | 7 | 6 | 21 | -12.2 |
| -20 / -16 | | | | | | 0 | 0 | 0 | 1 | -16.1 | 6 | 4 | 7 | 17 | -16.8 |
| -25 / -21 | | | | | | 0 | 0 | 0 | 1 | -22.6 | 4 | 2 | 3 | 9 | -21.5 |
| -30 / -26 | | | | | | 0 | | | 0 | -26.0 | 2 | 1 | 1 | 3 | -26.6 |
| -35 / -31 | | | | | | | | | | | 1 | 0 | 0 | 2 | -31.8 |
| -40 / -36 | | | | | | | | | | | 0 | 0 | | 0 | -37.5 |
| -45 / -41 | | | | | | | | | | | | | | | |

**Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.**

**BISMARCK ND** WMO No. 727640

**Dry-Bulb Temperature Hours For An Average Year (Sheet 5 of 5)**

**Period of Record = 1973 to 1996**

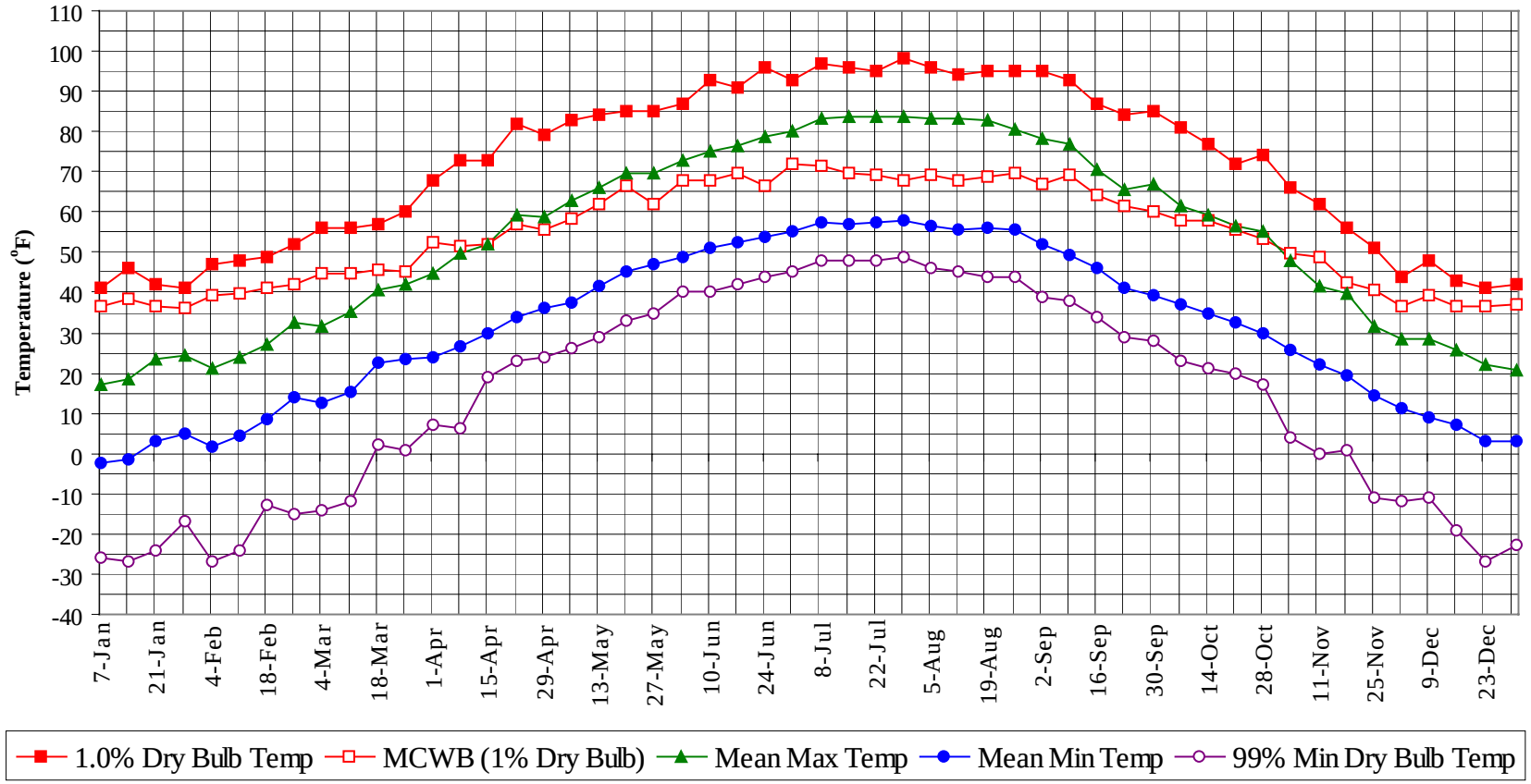
**Annual Totals**

| Temperature Range (°F) | Hour Group (LST) 01 To 08 | 09 To 16 | 17 To 00 | Total Obs | MCWB (°F) |
|---|---|---|---|---|---|
| **105 / 109** | | 0 | 0 | 1 | 69.8 |
| **100 / 104** | | 4 | 2 | 6 | 70.1 |
| **95 / 99** | | 14 | 7 | 21 | 69.2 |
| **90 / 94** | 0 | 46 | 25 | 71 | 68.2 |
| **85 / 89** | 1 | 86 | 50 | 136 | 66.4 |
| **80 / 84** | 3 | 145 | 86 | 233 | 64.5 |
| **75 / 79** | 14 | 200 | 134 | 348 | 62.2 |
| **70 / 74** | 54 | 220 | 172 | 447 | 60.0 |
| **65 / 69** | 126 | 211 | 200 | 537 | 57.7 |
| **60 / 64** | 222 | 193 | 221 | 636 | 54.8 |
| **55 / 59** | 247 | 175 | 207 | 629 | 50.8 |
| **50 / 54** | 252 | 170 | 194 | 616 | 46.7 |
| **45 / 49** | 207 | 155 | 167 | 529 | 42.1 |
| **40 / 44** | 211 | 177 | 189 | 577 | 37.8 |
| **35 / 39** | 232 | 190 | 212 | 634 | 33.7 |
| **30 / 34** | 278 | 183 | 228 | 689 | 29.8 |
| **25 / 29** | 233 | 149 | 184 | 566 | 25.3 |
| **20 / 24** | 199 | 134 | 149 | 482 | 20.7 |
| **15 / 19** | 149 | 107 | 120 | 376 | 16.0 |
| **10 / 14** | 115 | 93 | 95 | 303 | 11.0 |
| **5 / 9** | 104 | 75 | 82 | 261 | 6.1 |
| **0 / 4** | 75 | 59 | 66 | 200 | 1.2 |
| **-5 / -1** | 51 | 37 | 41 | 129 | -3.2 |
| **-10 / -6** | 56 | 40 | 43 | 139 | -7.5 |
| **-15 / -11** | 39 | 24 | 28 | 90 | -12.2 |
| **-20 / -16** | 23 | 12 | 20 | 55 | -16.8 |
| **-25 / -21** | 18 | 6 | 8 | 33 | -21.7 |
| **-30 / -26** | 7 | 2 | 2 | 12 | -26.5 |
| **-35 / -31** | 3 | 0 | 1 | 5 | -32.0 |
| **-40 / -36** | 1 | 0 | | 1 | -36.0 |
| **-45 / -41** | 0 | | | 0 | |

**Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.**

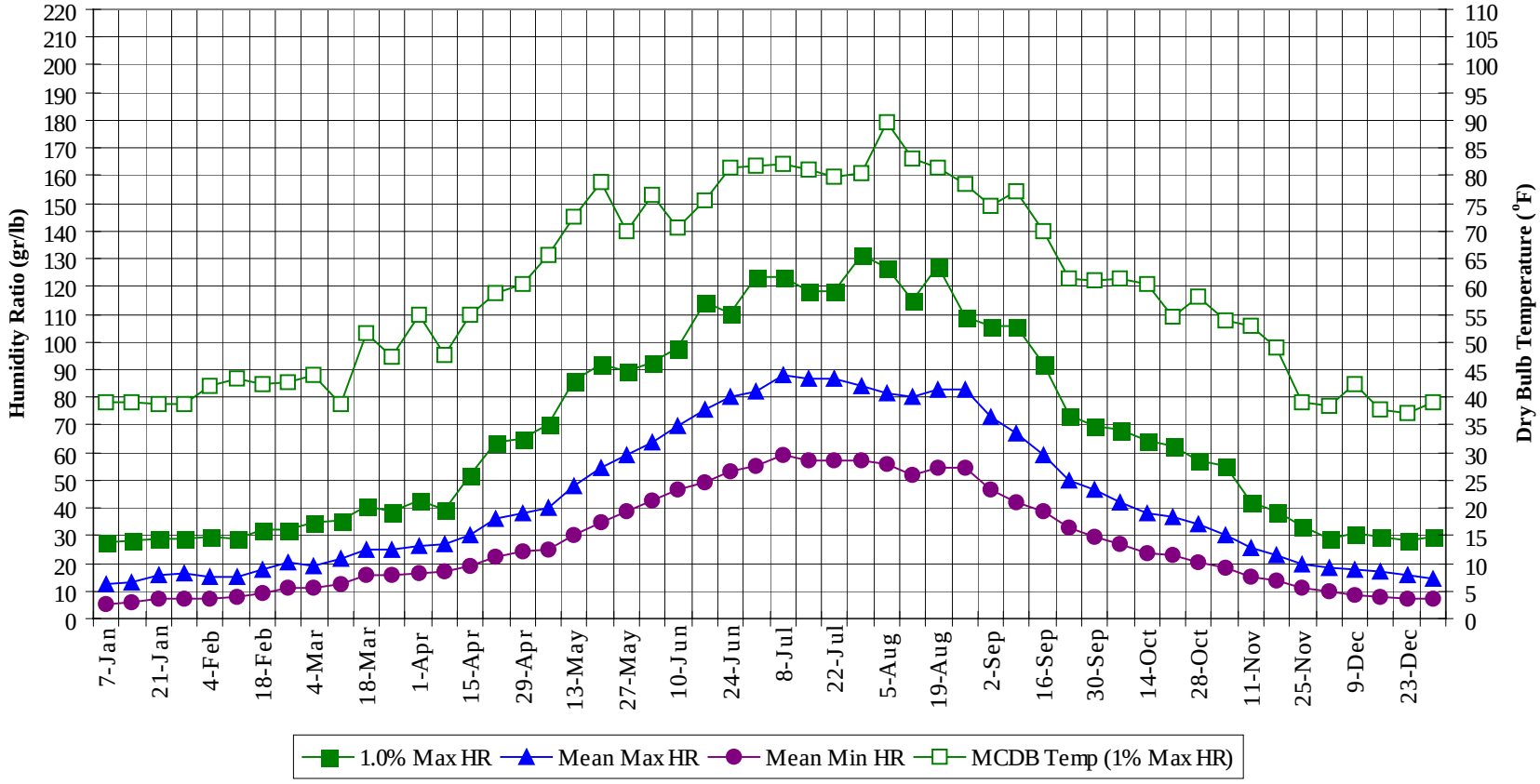
**BISMARCK ND** WMO No. 727640

## Annual Summary of Temperatures



**BISMARCK ND** WMO No. 727640

## Long Term Humidity and Dry Bulb Temperature Summary



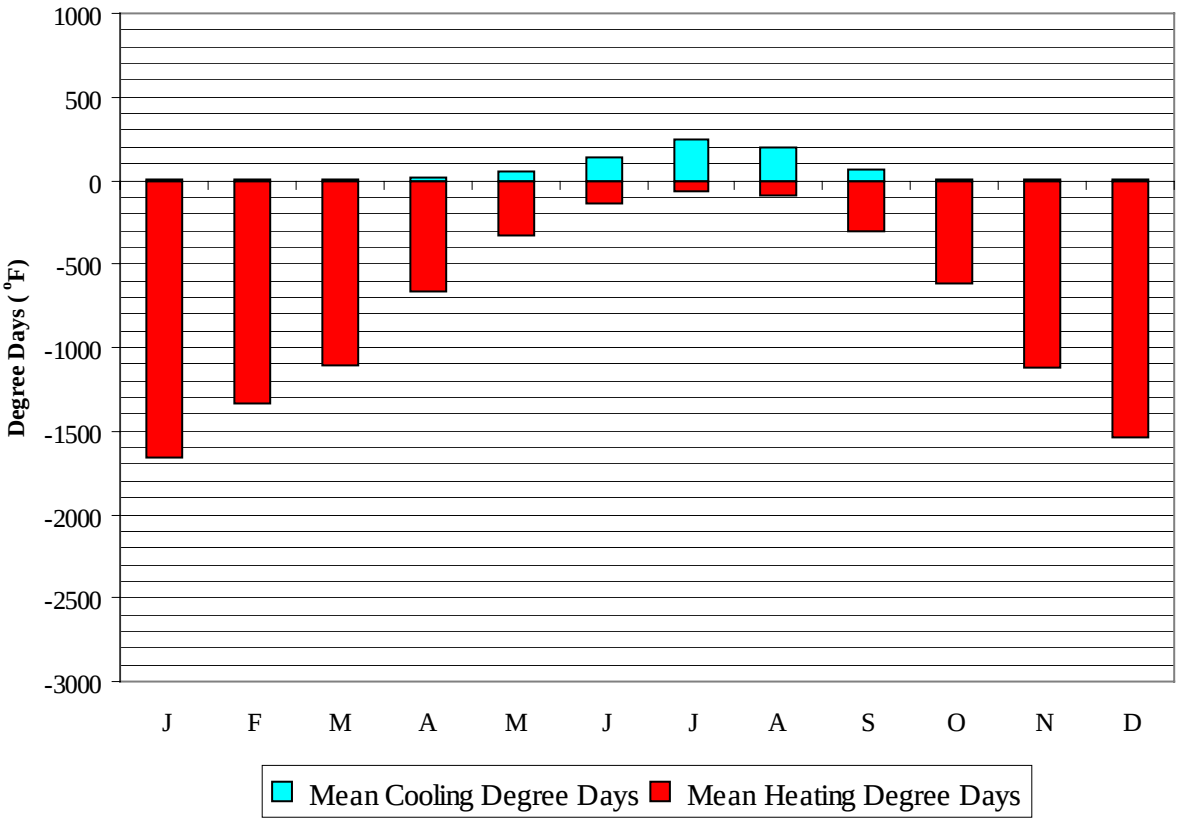
**BISMARCK ND** WMO No. 727640

## Long Term Dry Bulb Temperature and Humidity Summary

| Week Ending | 1.0% Temp (°F) | MCWB @ 1% Temp (°F) | Mean Max Temp (°F) | Mean Min Temp (°F) | 99% Temp (°F) | 1.0% HR (gr/lb) | MCDB @ 1% HR (°F) | Mean Max HR (gr/lb) | Mean Min HR (gr/lb) |
|---|---|---|---|---|---|---|---|---|---|
| 7-Jan | 41.0 | 36.4 | 17.1 | -2.4 | -26.0 | 27.3 | 39.1 | 12.2 | 5.5 |
| 14-Jan | 46.0 | 38.6 | 18.7 | -1.3 | -27.0 | 28.0 | 39.1 | 13.1 | 6.0 |
| 21-Jan | 42.0 | 36.7 | 23.4 | 3.1 | -24.0 | 28.7 | 38.7 | 16.0 | 7.1 |
| 28-Jan | 41.0 | 36.3 | 24.4 | 4.8 | -17.0 | 28.7 | 38.6 | 16.4 | 7.1 |
| 4-Feb | 47.0 | 39.4 | 21.2 | 1.5 | -27.0 | 29.4 | 42.1 | 14.8 | 7.3 |
| 11-Feb | 48.0 | 39.7 | 23.7 | 4.5 | -24.0 | 28.7 | 43.2 | 14.8 | 7.6 |
| 18-Feb | 49.0 | 41.3 | 27.2 | 8.6 | -13.0 | 32.2 | 42.4 | 17.9 | 9.4 |
| 25-Feb | 52.0 | 42.0 | 32.4 | 13.9 | -15.0 | 32.2 | 42.5 | 20.4 | 11.4 |
| 4-Mar | 56.0 | 44.8 | 31.7 | 12.6 | -14.0 | 35.0 | 44.2 | 19.3 | 11.0 |
| 11-Mar | 56.0 | 44.6 | 35.4 | 15.3 | -12.0 | 35.7 | 38.9 | 21.8 | 12.2 |
| 18-Mar | 57.0 | 45.5 | 40.4 | 22.5 | 2.0 | 40.6 | 51.7 | 24.9 | 15.6 |
| 25-Mar | 60.0 | 45.1 | 42.2 | 23.3 | 1.0 | 38.5 | 47.2 | 25.1 | 15.9 |
| 1-Apr | 68.0 | 52.6 | 44.7 | 23.9 | 7.0 | 42.7 | 54.9 | 26.1 | 16.3 |
| 8-Apr | 73.0 | 51.4 | 49.5 | 26.7 | 6.0 | 39.2 | 47.7 | 27.1 | 16.8 |
| 15-Apr | 73.0 | 52.2 | 52.2 | 29.7 | 19.0 | 51.8 | 54.8 | 30.2 | 18.7 |
| 22-Apr | 82.0 | 56.8 | 59.4 | 34.0 | 23.0 | 63.7 | 58.7 | 35.9 | 22.2 |
| 29-Apr | 79.0 | 55.5 | 58.6 | 36.1 | 24.0 | 65.1 | 60.5 | 37.9 | 24.4 |
| 6-May | 83.0 | 58.5 | 62.7 | 37.5 | 26.0 | 70.0 | 65.8 | 40.0 | 24.7 |
| 13-May | 84.0 | 61.9 | 66.0 | 41.5 | 29.0 | 86.1 | 72.7 | 48.1 | 30.0 |
| 20-May | 85.0 | 66.7 | 69.9 | 45.1 | 33.0 | 91.7 | 78.9 | 54.3 | 35.0 |
| 27-May | 85.0 | 62.0 | 69.8 | 46.8 | 35.0 | 89.6 | 69.9 | 59.3 | 38.5 |
| 3-Jun | 87.0 | 68.0 | 72.7 | 48.6 | 40.0 | 92.4 | 76.6 | 63.7 | 42.5 |
| 10-Jun | 93.0 | 67.9 | 75.1 | 50.9 | 40.0 | 98.0 | 70.7 | 69.6 | 46.7 |
| 17-Jun | 91.0 | 69.7 | 76.3 | 52.5 | 42.0 | 114.1 | 75.7 | 75.2 | 49.3 |
| 24-Jun | 96.0 | 66.3 | 78.6 | 53.6 | 44.0 | 110.6 | 81.6 | 80.3 | 52.9 |
| 1-Jul | 93.0 | 72.0 | 80.0 | 55.0 | 45.0 | 123.2 | 81.9 | 82.0 | 55.1 |
| 8-Jul | 97.0 | 71.3 | 83.2 | 57.5 | 48.0 | 123.2 | 82.1 | 88.3 | 59.2 |
| 15-Jul | 96.0 | 69.9 | 83.6 | 56.8 | 48.0 | 118.3 | 81.2 | 86.5 | 57.2 |
| 22-Jul | 95.0 | 69.1 | 83.8 | 57.4 | 48.0 | 118.3 | 79.8 | 87.0 | 57.4 |
| 29-Jul | 98.0 | 67.7 | 83.9 | 57.7 | 49.0 | 131.6 | 80.4 | 83.9 | 57.4 |
| 5-Aug | 96.0 | 69.4 | 83.1 | 56.6 | 46.0 | 126.7 | 89.7 | 81.4 | 55.6 |
| 12-Aug | 94.0 | 68.0 | 83.2 | 55.8 | 45.0 | 114.8 | 83.1 | 80.3 | 52.2 |
| 19-Aug | 95.0 | 68.9 | 82.8 | 56.0 | 44.0 | 127.4 | 81.5 | 82.9 | 54.6 |
| 26-Aug | 95.0 | 69.5 | 80.7 | 55.5 | 44.0 | 109.2 | 78.5 | 82.6 | 54.8 |
| 2-Sep | 95.0 | 66.9 | 78.3 | 51.9 | 39.0 | 105.7 | 74.4 | 72.9 | 46.3 |
| 9-Sep | 93.0 | 69.3 | 76.9 | 49.4 | 38.0 | 105.7 | 77.1 | 66.9 | 42.2 |
| 16-Sep | 87.0 | 64.3 | 70.6 | 46.0 | 34.0 | 91.7 | 69.9 | 59.0 | 38.5 |
| 23-Sep | 84.0 | 61.5 | 65.7 | 41.2 | 29.0 | 73.5 | 61.4 | 49.7 | 32.8 |
| 30-Sep | 85.0 | 59.9 | 66.8 | 39.4 | 28.0 | 69.3 | 61.1 | 46.7 | 29.9 |
| 7-Oct | 81.0 | 57.8 | 61.4 | 36.8 | 23.0 | 68.6 | 61.4 | 41.8 | 26.8 |
| 14-Oct | 77.0 | 57.8 | 59.4 | 34.7 | 21.0 | 64.4 | 60.6 | 38.1 | 23.9 |
| 21-Oct | 72.0 | 55.5 | 56.6 | 32.4 | 20.0 | 62.3 | 54.4 | 37.1 | 22.9 |
| 28-Oct | 74.0 | 53.6 | 55.3 | 30.0 | 17.0 | 57.4 | 58.1 | 34.0 | 20.3 |
| 4-Nov | 66.0 | 49.8 | 48.1 | 25.9 | 4.0 | 55.3 | 53.8 | 30.0 | 18.2 |
| 11-Nov | 62.0 | 48.8 | 41.6 | 21.9 | 0.0 | 42.0 | 53.0 | 25.4 | 15.0 |
| 18-Nov | 56.0 | 42.6 | 39.6 | 19.3 | 1.0 | 38.5 | 49.0 | 23.3 | 13.9 |
| 25-Nov | 51.0 | 40.7 | 31.4 | 14.3 | -11.0 | 33.6 | 39.1 | 19.6 | 11.2 |
| 2-Dec | 44.0 | 36.6 | 28.3 | 11.3 | -12.0 | 28.7 | 38.5 | 18.1 | 9.6 |
| 9-Dec | 48.0 | 39.5 | 28.5 | 8.9 | -11.0 | 30.8 | 42.5 | 18.0 | 8.7 |
| 16-Dec | 43.0 | 36.6 | 25.9 | 7.0 | -19.0 | 29.4 | 37.9 | 16.9 | 8.0 |
| 23-Dec | 41.0 | 36.4 | 22.2 | 2.9 | -27.0 | 28.0 | 37.0 | 15.7 | 6.9 |
| 31-Dec | 42.0 | 37.0 | 20.8 | 3.0 | -23.0 | 29.4 | 38.9 | 14.6 | 7.2 |

**BISMARCK ND** WMO No. 727640

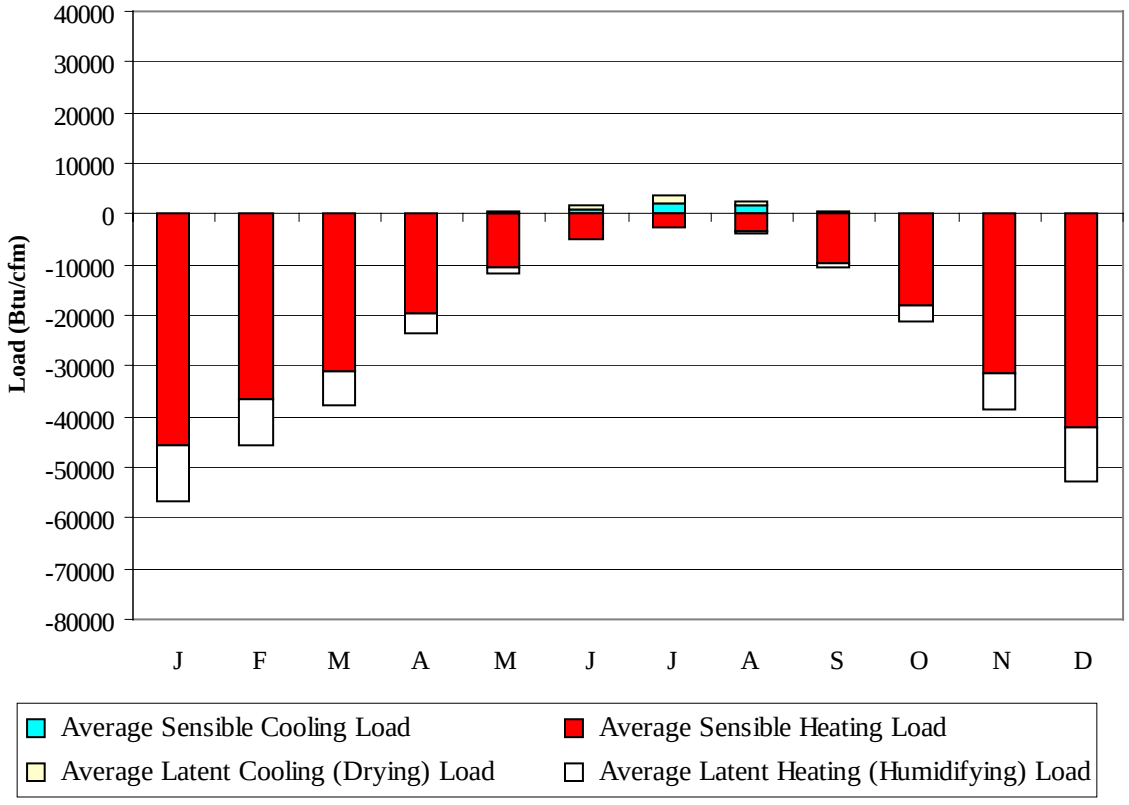
## Degree Days, Heating and Cooling
## (Base 65°F)




| | Mean Cooling Degree Days (°F) | Mean Heating Degree Days (°F) |
|---|---|---|
| JAN | 0 | 1663 |
| FEB | 0 | 1333 |
| MAR | 0 | 1105 |
| APR | 14 | 667 |
| MAY | 58 | 329 |
| JUN | 138 | 137 |
| JUL | 241 | 65 |
| AUG | 201 | 95 |
| SEP | 68 | 307 |
| OCT | 11 | 615 |
| NOV | 0 | 1123 |
| DEC | 0 | 1539 |
| ANN | 733 | 8978 |

**BISMARCK ND** WMO No. 727640

**Average Ventilation and Infiltration Loads**
**(Outside Air vs. 75°F, 60% RH summer; 68°F, 30% RH winter)**




| | Average Sensible Cooling Load (Btu/cfm) | Average Sensible Heating Load (Btu/cfm) | Average Latent Cooling Load (Btu/cfm) | Average Latent Heating Load (Btu/cfm) |
|---|---|---|---|---|
| JAN | 0 | -45511 | 0 | -11040 |
| FEB | 0 | -36747 | 0 | -8736 |
| MAR | 0 | -31040 | 0 | -6785 |
| APR | 68 | -19494 | 1 | -3876 |
| MAY | 299 | -10430 | 62 | -1140 |
| JUN | 1028 | -4876 | 564 | -34 |
| JUL | 2199 | -2608 | 1503 | -6 |
| AUG | 1780 | -3580 | 909 | -39 |
| SEP | 492 | -9765 | 133 | -599 |
| OCT | 38 | -18139 | 1 | -2891 |
| NOV | 0 | -31426 | 0 | -7218 |
| DEC | 0 | -42294 | 0 | -10287 |
| ANN | 5904 | -255910 | 3173 | -52651 |

# Average Annual Solar Radiation – Nearest Available Site

(Source: National Renewable Energy Laboratory, Golden CO, 1995)

| | |
|---|---|
| City: | BISMARCK |
| State: | ND |
| WBAN No: | 24011 |
| Lat(N): | 46.77 |
| Long(W): | 100.75 |
| Elev(ft): | 1647 |

Stn Type: Primary

SHADING GEOMETRY IN DIMENSIONLESS UNITS

| | |
|---|---|
| Window: | 1 |
| Overhang: | 0.729 |
| Vert Gap: | 0.328 |

AVERAGE INCIDENT SOLAR RADIATION (Btu/sq.ft./day), Percentage Uncertainty = 9

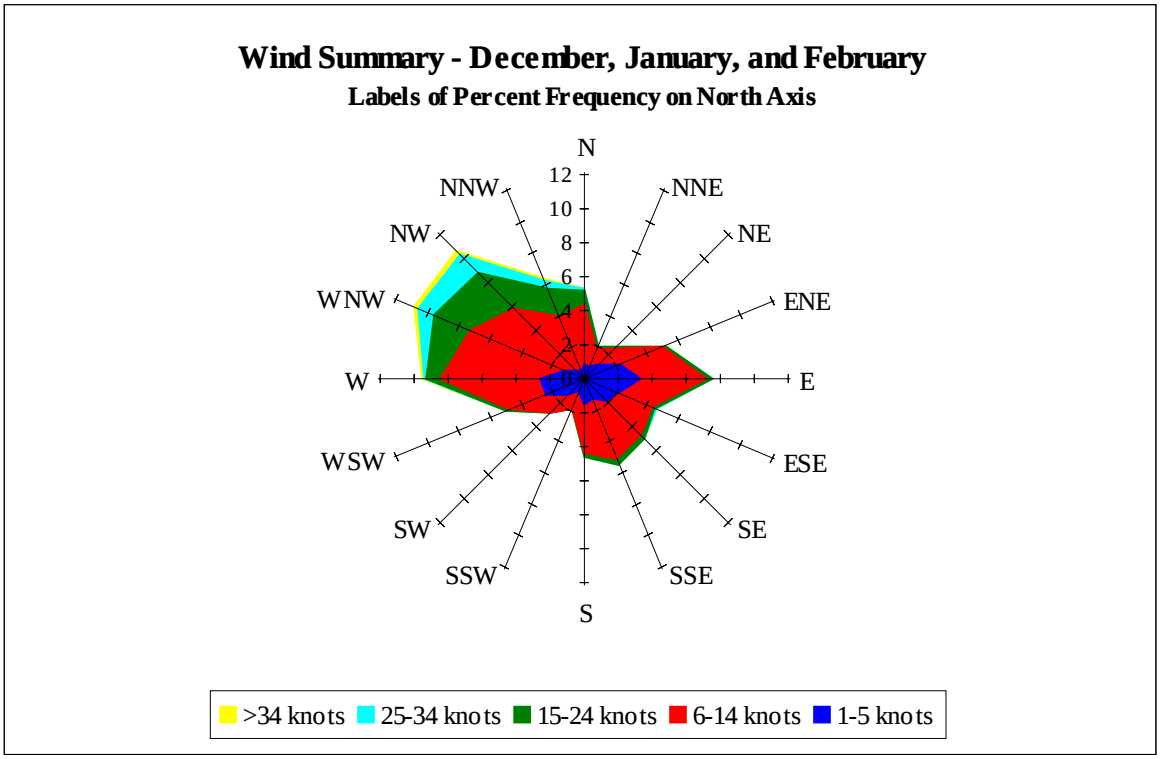
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HORIZ | Global | 530 | 820 | 1200 | 1550 | 1880 | 2090 | 2140 | 1830 | 1340 | 900 | 540 | 430 | 1270 |
| | Std Dev | 40 | 71 | 98 | 179 | 157 | 148 | 95 | 122 | 119 | 75 | 43 | 31 | 29 |
| | Minimum | 430 | 640 | 940 | 1130 | 1480 | 1820 | 1950 | 1530 | 1050 | 750 | 440 | 380 | 1220 |
| | Maximum | 600 | 950 | 1390 | 1930 | 2170 | 2380 | 2390 | 2010 | 1540 | 1060 | 640 | 480 | 1340 |
| | Diffuse | 280 | 430 | 580 | 680 | 770 | 780 | 710 | 620 | 480 | 360 | 270 | 240 | 520 |
| Clear Day | Global | 650 | 1020 | 1560 | 2120 | 2520 | 2680 | 2580 | 2220 | 1700 | 1130 | 710 | 550 | 1620 |
| NORTH | Global | 170 | 250 | 350 | 440 | 560 | 650 | 610 | 470 | 340 | 250 | 170 | 140 | 370 |
| | Diffuse | 170 | 250 | 350 | 420 | 500 | 530 | 510 | 440 | 340 | 250 | 170 | 140 | 340 |
| Clear Day | Global | 140 | 200 | 290 | 400 | 600 | 720 | 650 | 460 | 310 | 220 | 150 | 120 | 360 |
| EAST | Global | 390 | 560 | 790 | 980 | 1130 | 1200 | 1250 | 1110 | 870 | 630 | 380 | 310 | 800 |
| | Diffuse | 220 | 320 | 440 | 520 | 600 | 630 | 620 | 550 | 420 | 310 | 210 | 180 | 420 |
| Clear Day | Global | 580 | 830 | 1150 | 1410 | 1560 | 1610 | 1570 | 1430 | 1180 | 870 | 610 | 490 | 1110 |
| SOUTH | Global | 1070 | 1210 | 1260 | 1140 | 1030 | 980 | 1060 | 1180 | 1250 | 1230 | 980 | 930 | 1110 |
| | Diffuse | 360 | 460 | 540 | 560 | 590 | 600 | 590 | 550 | 480 | 400 | 330 | 310 | 480 |
| Clear Day | Global | 1830 | 2040 | 1990 | 1650 | 1320 | 1170 | 1210 | 1460 | 1790 | 1930 | 1820 | 1710 | 1660 |
| WEST | Global | 400 | 570 | 780 | 950 | 1100 | 1210 | 1260 | 1120 | 870 | 620 | 400 | 330 | 800 |
| | Diffuse | 220 | 320 | 440 | 530 | 610 | 640 | 620 | 550 | 430 | 310 | 220 | 180 | 420 |
| Clear Day | Global | 580 | 830 | 1150 | 1410 | 1560 | 1610 | 1570 | 1430 | 1180 | 870 | 610 | 490 | 1110 |

## Average Annual Solar Heat and Illumination – Nearest Available Site

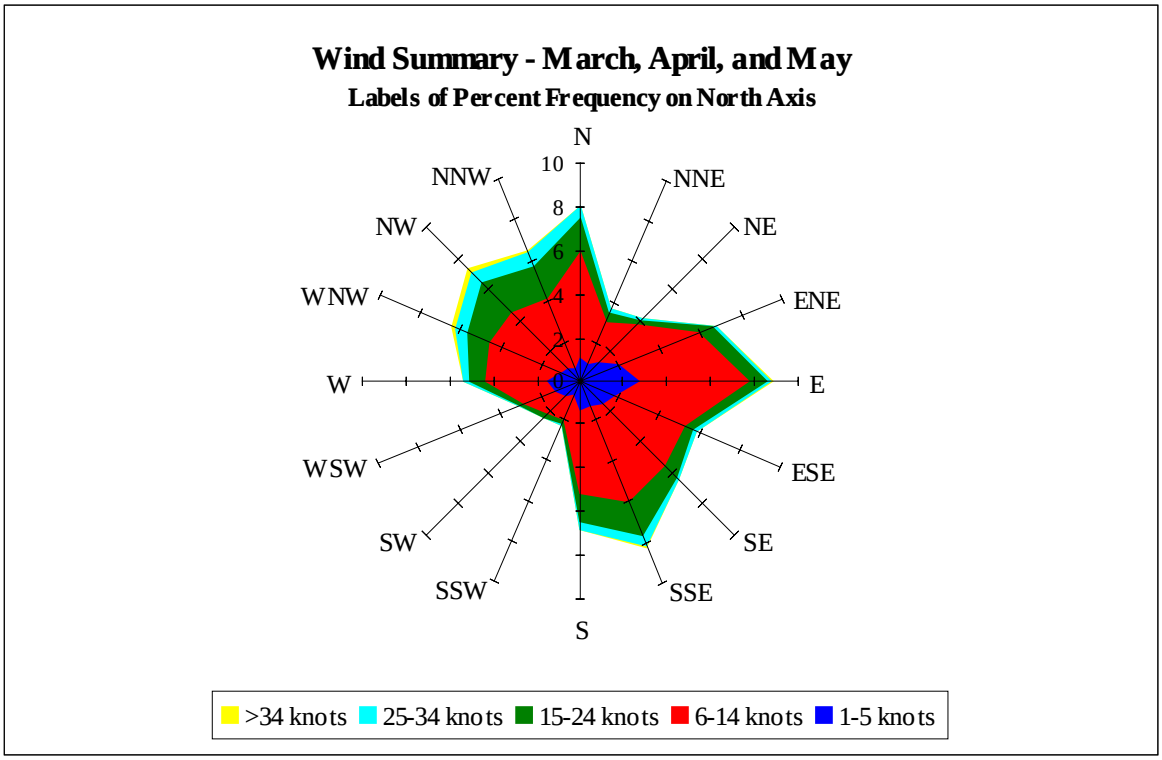
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

| AVERAGE TRANSMITTED SOLAR RADIATION (Btu/sq.ft./day) FOR DOUBLE GLAZING, Percentage Uncertainty = 9 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
| HORIZ | Unshaded | 320 | 540 | 830 | 1100 | 1360 | 1510 | 1560 | 1320 | 940 | 600 | 340 | 250 | 890 |
| NORTH | Unshaded | 120 | 170 | 240 | 300 | 370 | 420 | 400 | 310 | 230 | 170 | 120 | 98 | 250 |
| | Shaded | 96 | 140 | 200 | 250 | 310 | 360 | 340 | 270 | 200 | 140 | 97 | 80 | 210 |
| EAST | Unshaded | 260 | 390 | 560 | 700 | 810 | 860 | 890 | 800 | 620 | 440 | 260 | 210 | 570 |
| | Shaded | 230 | 320 | 450 | 560 | 630 | 670 | 700 | 640 | 510 | 370 | 220 | 180 | 460 |
| SOUTH | Unshaded | 820 | 900 | 900 | 770 | 660 | 610 | 660 | 780 | 870 | 910 | 740 | 710 | 780 |
| | Shaded | 790 | 810 | 660 | 430 | 340 | 350 | 350 | 370 | 560 | 770 | 710 | 690 | 570 |
| WEST | Unshaded | 270 | 400 | 550 | 680 | 790 | 860 | 900 | 800 | 620 | 440 | 280 | 230 | 570 |
| | Shaded | 230 | 340 | 450 | 540 | 620 | 680 | 710 | 640 | 500 | 360 | 230 | 190 | 460 |

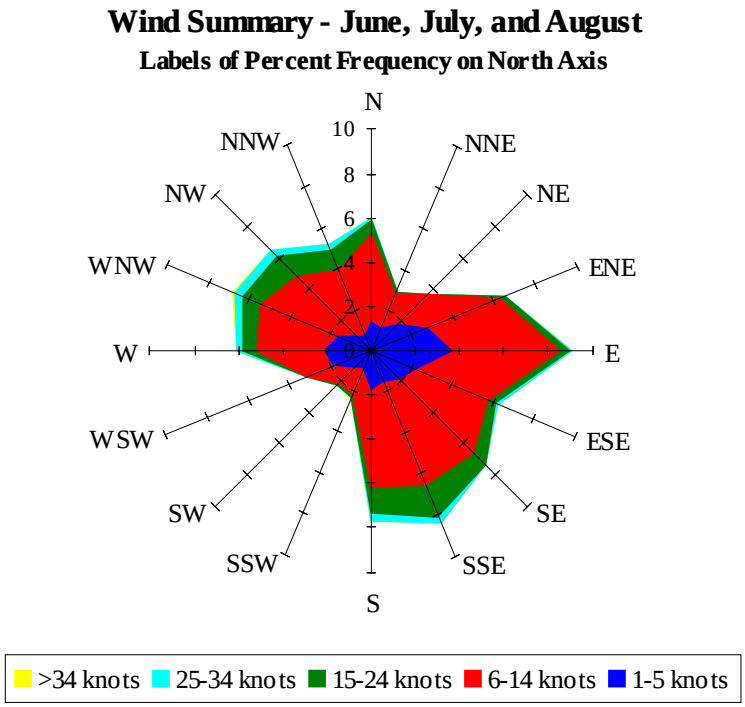
| AVERAGE INCIDENT ILLUMINANCE (klux-hr) FOR MOSTLY CLEAR AND MOSTLY CLOUDY CONDITIONS, Percentage Uncertainty = 9 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | March | | | | | June | | | | |
| | | 9am | 11am | 1pm | 3pm | 5pm | 9am | 11am | 1pm | 3pm | 5pm |
| HORIZ. | M.Clear | 23 | 58 | 74 | 66 | 36 | 38 | 74 | 95 | 97 | 79 |
| | M.Cloudy | 15 | 40 | 53 | 47 | 25 | 24 | 50 | 67 | 71 | 57 |
| NORTH | M.Clear | 7 | 12 | 14 | 13 | 9 | 20 | 14 | 16 | 16 | 15 |
| | M.Cloudy | 6 | 14 | 17 | 15 | 10 | 13 | 16 | 18 | 18 | 17 |
| EAST | M.Clear | 64 | 68 | 24 | 13 | 9 | 76 | 81 | 47 | 16 | 15 |
| | M.Cloudy | 23 | 36 | 21 | 15 | 10 | 33 | 47 | 35 | 18 | 17 |
| SOUTH | M.Clear | 27 | 71 | 92 | 82 | 45 | 10 | 31 | 55 | 57 | 38 |
| | M.Cloudy | 12 | 38 | 53 | 46 | 22 | 9 | 24 | 40 | 43 | 29 |
| WEST | M.Clear | 7 | 12 | 14 | 55 | 73 | 10 | 14 | 16 | 36 | 75 |
| | M.Cloudy | 6 | 14 | 17 | 34 | 33 | 9 | 16 | 18 | 30 | 50 |
| M.Clear | (% hrs) | 30 | 28 | 25 | 25 | 27 | 40 | 39 | 38 | 34 | 35 |
| | | Sept | | | | | Dec | | | | |
| | | 9am | 11am | 1pm | 3pm | 5pm | 9am | 11am | 1pm | 3pm | 5pm |
| HORIZ. | M.Clear | 14 | 51 | 75 | 76 | 54 | 1 | 23 | 35 | 26 | 3 |
| | M.Cloudy | 8 | 31 | 48 | 49 | 36 | 1 | 16 | 25 | 18 | 3 |
| NORTH | M.Clear | 5 | 11 | 14 | 14 | 12 | 1 | 7 | 9 | 8 | 2 |
| | M.Cloudy | 4 | 11 | 15 | 15 | 12 | 0 | 7 | 10 | 8 | 2 |
| EAST | M.Clear | 48 | 75 | 43 | 14 | 12 | 4 | 40 | 12 | 8 | 2 |
| | M.Cloudy | 15 | 35 | 28 | 15 | 12 | 1 | 16 | 11 | 8 | 2 |
| SOUTH | M.Clear | 10 | 51 | 79 | 81 | 55 | 3 | 63 | 87 | 69 | 13 |
| | M.Cloudy | 5 | 26 | 44 | 46 | 31 | 1 | 23 | 36 | 28 | 4 |
| WEST | M.Clear | 5 | 11 | 14 | 36 | 72 | 1 | 7 | 9 | 38 | 15 |
| | M.Cloudy | 4 | 11 | 15 | 25 | 38 | 0 | 7 | 10 | 18 | 5 |
| M.Clear | (% hrs) | 45 | 44 | 43 | 43 | 42 | 29 | 30 | 29 | 32 | 34 |



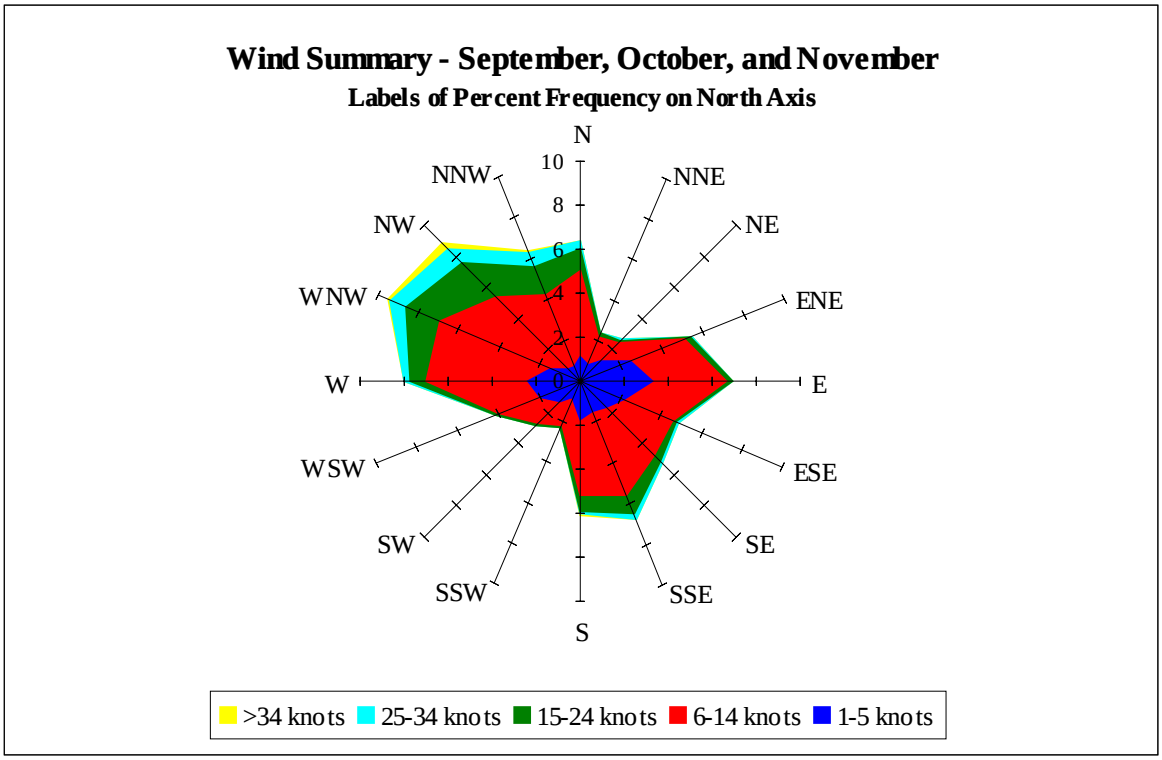

Percent Calm = 11.84




Percent Calm = 8.89




Percent Calm = 10.46




Percent Calm = 11.54